

CLAIMS

1. A retrievable filter for filtering solid and semi-solid materials from a liquid moving axially in a generally tubular vessel of a mammal comprising:

- a) a filter;
- b) a stent; and
- c) a locking mechanism releasably attaching said filter to said

stent.

2. The retrievable filter of claim 1 wherein said locking mechanism further comprises a stent attachment means and a filter attachment means.

3. The retrievable filter of claim 1 wherein said stent is configured to engage a wall of said generally tubular vessel and become incorporated by endothelial tissue.

4. The retrievable filter of claim 1 wherein said filter further comprises an apical hub.

5. The retrievable filter of claim 1 wherein said filter further comprises a plurality of divergent legs.

6. The retrievable filter of claim 5 wherein at least one of said plurality of divergent legs is secured at one end to an apical hub and at least one of said plurality of divergent legs is releasably secured at an opposite end to said stent by said locking mechanism.

7. The retrievable filter of claim 6 wherein said locking mechanism further comprises a stent attachment means and a filter attachment means, said stent attachment means is secured to said opposite end of said at least one of said plurality of divergent legs, said filter attachment means is secured to said stent and said filter attachment means is releasably secured to said stent attachment means.

8. The retrievable filter of claim 1 further comprising a retention force capable of withstanding said liquid moving axially in said generally tubular vessel and a retrieval force to detach said filter from said stent, wherein said retention force is greater than said retrieval force.

9. The retrievable filter of claim 1 wherein said filter is configured to maintain its structure when said filter is detached from said stent.

10. The retrievable filter of claim 2 wherein said filter is configured to maintain its structure when said stent attachment means is detached from said filter attachment means.

11. The retrievable filter of claim 1 wherein said filter is configured to avoid contact with said generally tubular vessel.

12. The retrievable filter of claim 1 wherein said locking mechanism is configured to position said filter to avoid contact with said generally tubular vessel.

13. The retrievable filter of claim 5 wherein said locking mechanism is configured to position at least one of said plurality of divergent legs to avoid contact with said generally tubular vessel.

14. The retrievable filter of claim 2 wherein at least one of said filter attachment means and said stent attachment means is configured to position said filter to avoid contact with said generally tubular vessel.

15. The retrievable filter of claim 7 wherein at least one of said filter attachment means and said stent attachment means is configured to position said at least one of said plurality of filter legs to avoid contact with said generally tubular vessel.

16. The retrievable filter of claim 1 wherein said locking mechanism is configured to avoid contact with the tubular vessel.

17. The retrievable filter of claim 2 wherein at least one of said filter attachment means and said stent attachment means is configured to avoid contact with said generally tubular vessel.

18. The retrievable filter of claim 1 wherein said stent is a square stent.

19. The retrievable filter of claim 1 wherein said stent is a z-stent.

20. The retrievable filter of claim 1 wherein said stent is self-expanding.

21. The retrievable filter of claim 1 wherein said stent is balloon expandable.

22. The retrievable filter of claim 2 wherein said filter attachment means and said stent attachment means form an interference fit.

23. The retrievable filter of claim 2 wherein one of said filter attachment means and said stent attachment means comprises a cannula.

24. The retrievable filter of claim 2 wherein one of said filter attachment means and said stent attachment means comprises an attachment wire.

25. The retrievable filter of claim 24 wherein said attachment wire further comprises an extension of one of said filter and said stent.

26. The retrievable filter of claim 24 wherein said attachment wire further comprises a bend.

27. The retrievable filter of claim 24 wherein said attachment wire further comprises a ball and one of said filter attachment means and stent attachment means further comprises a slot and a ball recess.

28. The retrievable filter of claim 24 wherein said attachment wire comprises a Y-shaped adapter.

29. The retrievable filter of claim 28 wherein said Y-shaped adapter further comprises a Y-shaped prong.

30. The retrievable filter of claim 24 wherein said attachment wire comprises a looped adapter.

31. The retrievable filter of claim 30 wherein said looped adapter further comprises a looped wire.

32. The retrievable filter of claim 24 wherein said attachment wire comprises a coiled adapter.

33. The retrievable filter of claim 32 wherein said coiled adapter further comprises a coil.

34. The retrievable filter of claim 1 wherein said locking mechanism further comprises a coiled locking mechanism, said coiled locking mechanism comprising at least one coil.

35. The retrievable filter of claim 34 wherein said at least one coil is formed from a shape memory alloy.

36. The retrievable filter of claim 1 wherein said retrievable filter is configured so that a user can decrease the force required to detach the filter from the stent to remove the filter.

37. The retrievable filter of claim 7 further comprising a retrieval connection point and at least one attachment wire;
wherein said at least one of said plurality of divergent legs further comprises at least one cannula and at least one lumen;
wherein said at least one attachment wire extends through said at least one lumen and is attached at said retrieval connection point;
wherein said retrieval connection point further comprises a hook;

wherein said hook is configured so that an upward motion applied to said hook disengages said at least one attachment wire of said stent attachment means from said filter attachment means.

38. The retrievable filter of claim 37 wherein said apical hub further comprises an apical hook.

39. The retrievable filter of claim 37 wherein said apical hub further comprises a locking ring.

40. A retrievable filter for filtering solid and semi-solid materials from a liquid moving axially in a generally tubular vessel of a mammal comprising:

a) a filter comprising a plurality of divergent legs each having an upstream end and a downstream end, each of said plurality of divergent legs further comprising a cannula and a lumen;

b) an apical hub connecting each of said downstream ends of said plurality of divergent legs;

c) a stent configured to engage a wall of said generally tubular vessel and become incorporated by endothelial tissue;

d) a locking mechanism comprising a stent attachment means attached to said filter and a filter attachment means attached to said stent, said stent attachment means is releasably secured to said filter attachment means for releasably securing said filter to said stent, said stent attachment means further comprising at least one attachment wire, said at least one attachment wire extends through at least one lumen of said plurality of divergent legs and is attached at a retrieval connection point;

wherein an upward motion applied to said retrieval connection point disengages said at least one attachment wire of said stent attachment means from said filter attachment means.

41. A method for positioning in a lumen at a desired implantation site the retrievable filter of claim 1 comprising the steps of:

advancing a guidewire into a lumen beyond the desired implantation site;

advancing a catheter comprising a dilating cannula and a sheath over the guidewire to the desired implantation site;

removing the dilating cannula and guidewire;

inserting the retrievable filter of claim 1 into the sheath and advancing the retrievable filter of claim 1 to the desired implantation site.

42. The method of claim 40 wherein the step of inserting the retrievable filter of claim 1 into the sheath and advancing the retrievable filter of claim 1 to the desired implantation site is performed using a second catheter.

43. A method for retrieving from a desired implantation site in a lumen the retrievable filter of claim 1 comprising the steps of:

advancing a guidewire into the lumen to the implantation site;

advancing a catheter over the guidewire to a retrieval connection point of the filter;

withdrawing the guidewire and advancing a retrievable loop through the catheter to the retrieval connection point of the filter;

grasping the retrieval connection point of the filter with the retrievable loop;

withdrawing the retrievable loop and the grasped retrieval connection point of the filter into the catheter and thereby causing locking mechanism to release filter from stent and collapsing filter within catheter.